elektra.eu

ELEKTRA
TuffTec™
HEATING CABLES

- TuffTec™ 30
- TuffTec™ 30/400 V

Installation manual

Applications

ELEKTRA TuffTec™ heating cables are intended for effective prevention of snow and ice deposition on:

- driveways, roads, footbridges, loading ramps and parking spaces with asphalt or concrete surface,
- roofs covered with bituminous materials,
- gutters and downpipes requiring the output of 60 W/m.

Characteristics

ELEKTRA TuffTec™ heating cables feature the following characteristics:

- high mechanical strength
  - cables intended for installations characterised by increased risk of mechanical damages
- high thermal properties
  - max. operating temperature: +110°C
  - max. exposure temperature (10 min): +240°C
  - min. installation temperature: -25°C
- UV-Resistant
- resistance against chemical agents, including bituminous substances.

ELEKTRA TuffTec™ cables are intended for installation in the conditions of increased risk of mechanical damages, e.g. in case when concrete consolidation machinery is utilized for surface works.

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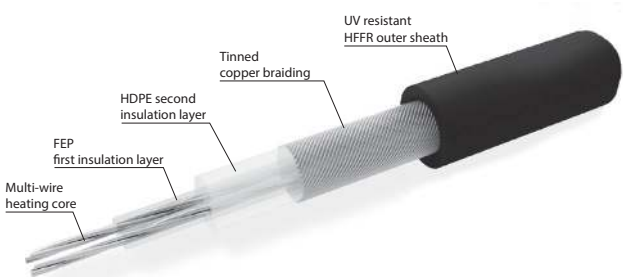
Due to their exceptionally high thermal properties, as well as resistance against bituminous substances, the TuffTec™ cables can be safely laid in asphalt.

Also, the cables can be laid on the roofs with bituminous coverings.



Construction of the ELEKTRA TuffTec™ heating cable

Technical properties

The ELEKTRA TuffTec™ heating cables are produced in ready-made units, manufactured in compliance with the EN 60335-1 standard.

The ready-made units include heating cables terminated with a power supply conductor.

Power output	30 W/m
Power supply voltage	230 V, 400 V ~ 50/60 Hz
Cable diameter	~ 6.8 mm
Min. installation temperature	-25°C
Max. operating temperature	+110°C
Max. exposure temperature (10 min.)	+240°C
Power supply conductors	1 x 4 m; 3 x 1.5 mm² or 3 x 2.5 mm² rubber insulation and outer jacket
Heating cables	double-core, screened, single-side powered
Insulation	double layer, FEP + HDPE
Outer sheath	UV-resistant HFFR
Rated power output tolerance	+5%, -10%
Min. cable bending radius	3.5 D
IP rating	IPX7
System certification	according to ISO 9001 IQNET, PCBC
Markings	CE

1. "cold" power supply conductor
2. ELEKTRA TuffTec™ heating cable
3. connecting joint between the power supply conductor and the heating cable

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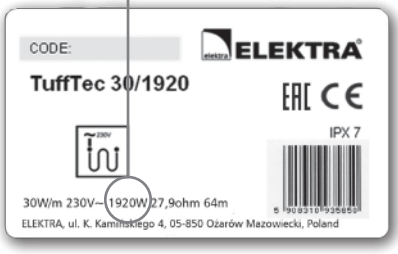
Note:

ELEKTRA TuffTec™ 30 heating cables are designed for the rated voltage 230 V/50 Hz, and TuffTec™ 30/400 heating cables – for the rated voltage 400 V/50 Hz.

Heating cables' heating output may vary with +5% and -10% from the nameplate values.



Self-adhesive label

The label features the following pictograph:

Single-side powered heating cables

Note:

Never cut the heating cable.

Never trim the heating cable, only the power supply conductor may be trimmed if required.

Never squash the "cold tail".

Do **not ever** undertake on your own any attempts to repair the heating cables, and in case any damage is detected, report the damage to an ELEKTRA authorized installer.

Never stretch or strain the cable excessively, nor hit it with sharp tools.

Do **not** install the heating cables when ambient temperature drops below -25°C.

Note:

Never lead the end joint and the connecting joint between the heating cable and the power supply conductor out of the surface. Both joints must be placed – depending on the type of surface – within the layer of sand, dry concrete or directly in concrete.

Never bend the joint and end seal.

Heating cables must be installed according to the Instructions.

Mains connection of the heating cables **should be** performed by an authorized electrician.

Power supply conductors ("cold tails") in asphalt **should be** positioned in the protective metal installation conduit. Alternatively, power supply conductors can be led out of the area where asphalt will be poured out.

General information

Surface protection against snow and ice deposition

When protecting external areas from snow and ice deposition, it is required to assess the required heat output value per m2 of the surface. Recommended heat output depends on the regional climate conditions, i.e. minimum ambient temperature, snowfall intensity and wind strength.

Ambient temperature	Heat output [W/ m^2]
> -5°C	200
-5°C ÷ -20°C	300
-20°C ÷ -30°C	400
< -30°C	500

Higher output is required if the heated area is:

- exposed to wind from below:
  - bridges, stairs, loading ramps, overpasses
- located in a regions of intense snowfall

Applying insulation layer to the surfaces exposed to wind from below can improve effectiveness.

Depending on the cable spacing, it is possible to obtain required output per m^2 of the heated area.

Heat output	30 W/m
[W/m^2]	[cm]
300	10
375	8
430	7
500	6
600	5

Cable spacing cannot drop below 5 cm.

To protect large areas against snow and ice deposition, one option is application of 400 V voltage heating cables, which would evenly load the electric circuit. Application of such cables would also reduce installation works, limiting the required number of heating cables.

Protection of bituminous roofs, gutters and downpipes against snow and ice deposition

Thanks to their exceptionally high resistance against damaging influence of any bituminous substances, ELEKTRA TuffTec™ heating cables are ideally suited for the purposes of heating roofs covered with tar paper, roof tiles or bituminous shingles.

Selection of the required heat output depends on the regional climate conditions of the zone where the installation is to be positioned.

It is recommended to heat gutters and roof edges adjoining them on the width of approximately 50 cm, as well as roof channels. Effective heating of these elements will facilitate roof outflow of melted snow, and will prevent icicles.

Tar paper-covered roofs are usually flat (up to 15°) and require higher heat output. Especially roof valleys and channels are exposed to snow deposition.

Heat output for the moderate climate zone

ELEKTRA TuffTec™ heating cables can be installed

Application	Heat output [W/ m^2]
Roof channels	200-300
Roof edges	approx. 200
Roof stretches excessing the building's facade	approx. 300

in gutters or downpipes of buildings located in cold climate zones, where it is also necessary to execute high heat output, i.e. 60 W/m by double-laying the cables in gutters.

Controls

Properly selected control system will ensure adequate operation of the heating system only during snow and freezing rainfall. A temperature controller with a temperature and moisture sensor will automatically recognize the weather conditions. The heating system will be then kept on standby and only switched on when actually necessary.
For this purpose, DIN-bus installed controllers ELEKTRA ETR2, Smart ControlTec SMC and ETO2 can be utilised.

Anti-snow and anti-ice controls

- ***for the protection of surfaces***

ELEKTRA ETR2 controller – max. load up to 16 A, total output of installed heating cables must not exceed 3600 W. As standard, equipped with one temperature and moisture sensor with installation tube.

ELEKTRA ETOG2 controller – max. load up to 3x16 A. For applications in extended heating systems.

As standard, equipped with one temperature and moisture sensor and an installation tube. Additional temperature and moisture sensor can be connected to this controller, which will enable protection of two outdoor areas.

ELEKTRA SMCG controller – max. load up to 2x16 A.

For applications in extended heating systems.

Enables remote operation via a web browser and signaling of operating status or errors.

As standard, equipped with one temperature and moisture sensor and an installation tube. Additional temperature and moisture sensor can be connected to this controller, which will enable protection of two outdoor areas.

- ***for the protection of roofs, gutters and downpipes***

ELEKTRA ETR2R controller – as standard, equipped with one air temperature sensor and moisture sensor.

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ELEKTRA ETOR2 controller – as standard, equipped with one air temperature sensor and moisture sensor. Additional moisture sensor can be connected to this controller, which will enable protection of two independent roof areas.

Additionally, in SMC and ETO2 controllers it is possible to control two indepen-dent areas, e.g. a garage driveway and gutters, with one controller only.

ELEKTRA SMCR controller – max. load up to 2x16 A.

For applications in extended heating systems.

Enables remote operation via a web browser and signaling of operating status or errors.

As standard, equipped with one air temperature sensor and moisture sensor. Additional moisture sensor can be connected to this controller, which will enable protection of two independent roof areas.

Installation

Stage 1: Heating cable's installation

1) in the surface

Before commencing the installation of the system, it is required to assess the necessary heat output per m^2, as well as calculate the required spacing of the heating cable.

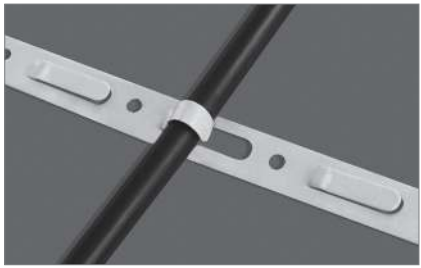
In order to calculate the required heating cable's spacing, apply the following formula:

$$a\text{-}a = S/L$$

where:

a-a: distances between cables,
S: surface area, for the surface heated with the heating cable,
L: heating cable's length.

To maintain fixed positioning of the cable and steady spacing conforming to the calculated values, the cables need to be attached with the ELEKTRA TMS installation tape (the tape should be positioned with the distances of 40 cm) or installation mesh of 5 cm x 5 cm grid, made of Ø 2 mm wire.



TMS installation tape

The heating cable layout should be commenced from the side of the power supply conductor, in such a way to enable easy reach to the switchboard.
If the cold tail needs to be extended, a heat shrink joint must be used. Ensuring that the connection is safely sealed.

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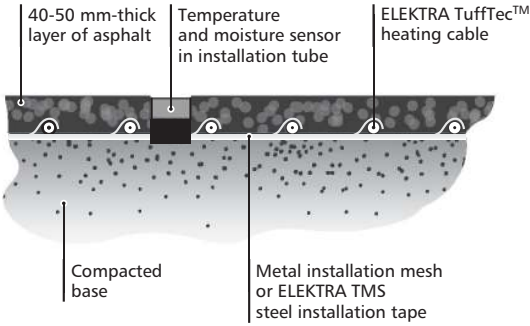
The heating cable layout will depend from the surface type.

Asphalt surfaces

Stages of works:

- Metal installation tape or mesh is placed on the compacted (hard core) base, with the heating cable attached to it – installation tape's tongues should be folded so that they would not straighten up during asphalt rolling
- Power supply conductors ("cold tails") in asphalt should be positioned in the protective metal installation conduit. Alternatively, power supply conductors can be led out of the area where asphalt will be poured out
- The 40-50 mm-thick layer of asphalt is laid out manually – Stage 4
- The asphalt surface is rolled – Stage 4



Cross section of a driveway or road with asphalt surface

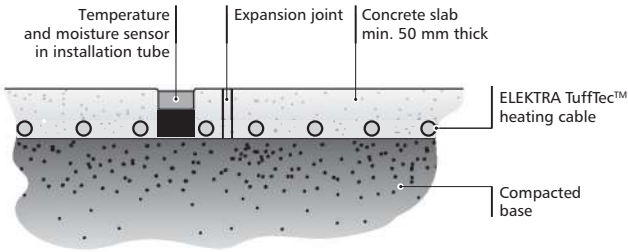
Concrete surfaces

Concrete surfaces require epansion joints. Unreinforced concrete slabs should be divided into expanded areas of the surface no larger than 9 m^2, reinforced concrete flagstones – into areas no larger than 35 m^2. The length of the heating cables should be selected so that they would not cross the expansion joints. Only the power supply conduits ("cold tails") can cross the expansion joints. They are to be placed in a metal protective conduit of the length of approx. 500 mm.

Unreinforced concrete surfaces

Stages of works:

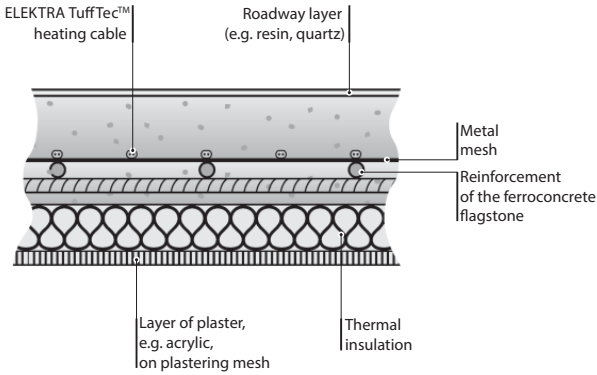
- The compacted base is levelled
- ELEKTRA TMS installation tape or installation mesh are laid on the compacted base, the heating cable is fastened to them
- The concrete slab works follow – Stage 4



Cross section of a pavement or driveway made of concrete slab

Reinforced concrete flagstones

Heating cables can be fastened to the reinforcement of the ferroconcrete flagstones. Alternatively, the installation mesh of 100 mm x 100 mm grid made of Ø 4 mm wire can be applied, which would facilitate maintaining steady spacing of the cable, conforming to the calculated values.



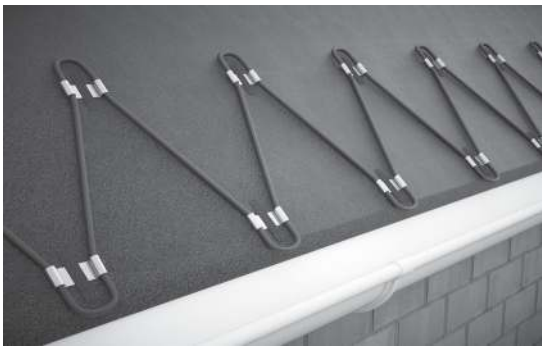
Cross section of a suspended loading ramp

Applying thermal insulation layer to ferroconcrete flagstone surfaces exposed to wind operation from below (ramps, bridges, overpasses) can improve the system's effectiveness.

2) on roofs covered with tar-paper, roof tiles or bituminous shingles

Fastening cables to roofs' edges

The grips are attached to the roof's stretches with pieces of heat-sealing tar paper glued across the grips.

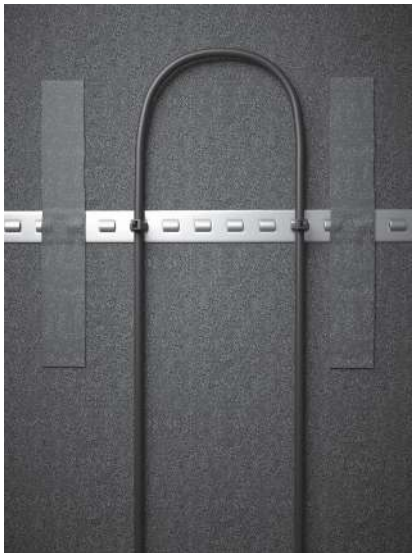


RE-IH-ZNTI titanium-zinc or RE-IH-1-CU copper holders

Fastening cables in roof valleys

RT-L500-S-AL installation strip

Alluminium self-adhesive installation strips are attached to the roof's stretches with pieces of heat-sealing tar paper glued across the strips.



Downpipes receiving water from roof valleys require heating:

- internal downpipes at the length of approx. 1 m
- external downpipes at their entire length

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Basic accessories for installation of heating cables in gutters and downpipes:

GH-2 gutter holder

GSW-2 gutter spacing wire
(this method of installation will greatly facilitate cleaning)

DSC-2 downpipe spacing clip

DSW-2 downpipe spacing wire

Stage 2: After the heating cable has been laid

At this stage, it is necessary to undertake the following steps:

- Stick into the Warranty Card the self-adhesive label, positioned on the power supply conductor of the heating cable
- In the Warranty Card, prepare a sketch of the heating cable's layout positioning
- Feed the power supply conductor of the heating cable into the switchboard
- Perform the measurements of:
  - heating wire resistance
  - insulation resistance

  The measurement results of the heating core's resistance should not vary from the one given on the label value with more than -5%, +10%.

  The heating cable insulation's resistance, as measured with an appliance of the rated voltage 1000 V (megaohmmeter), for at least 30 seconds and its value should not drop below 50 MΩ. Enter the results into the Warranty Card.

  After the surface has been completed, repeat the measurements to check whether the heating cable has not been damaged while conducting works.

Note: !

In case of planned delay in connection of the heating cable to the electrical installation, seal the power supply cable of the heating cable against the possibility of internal moisture penetration using a protective cap placed on the conduit or a heat shrinkable end cap.

Heating Cables

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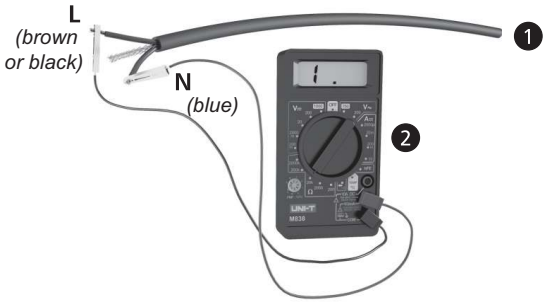


Heating wire's resistance measurement

Insulation's resistance measurement

1	Power supply conductor
2	Ohmmeter
3	Megaohmmeter

Stage 3: Temperature and moisture sensor's installation: preparation to in-surface installation

- Establish the optimal positioning for the temperature and moisture sensor – a place which would be especially vulnerable to prolonged low temperatures and increased moisture deposition (e.g. in a shade or exposed to wind).

Note: !

Fill the spot selected for the sensor's installation with material to be removed after concrete or asphalt has been cured (e.g. a wooden block of 100 x 100 mm and the height equal to the planned thickness of the finished surface).

- Feed the protective conduit with the so called "draw wire" from the planned sensor's positioning to the switchboard (after the surface has been completed, the protective conduit will enable feeding the temperature and moisture sensor's wire).

Note: !

The protective conduit should be run in such a way to enable the future exchange of the temperature and moisture sensor, if required.

In case of a significant sensor's distance from the switchboard, or bending of the protective conduit, it is necessary to:

- install an additional sealed electric box "on the way" to the board, or
- install the protective conduit with a twisted pair screened control cable, min. 3-pair (e.g. LIYCY-P 3x2x1.5)
  - the sensor's wire with the control cable is to be connected with a heat shrink connecting joint

Note:

The section of the protective conduit to be laid in asphalt should be made of a metal pipe, due to high temperatures present while asphalting.

Stage 4: Finishing surface works

During execution of the asphalt surface, first select the positioning place for the installation tube, then – after the asphalt has been rolled and it has cooled down – mount the tube. The space between the tube and asphalt should be filled with either concrete or asphalt poured cold, and the tube should be levelled so that it will be positioned 5 mm below the level of the surface.

For the time of pouring and rolling the asphalt, the place selected for the positioning of the sensor should be filled with material which – after the asphalt has cooled down – will be removed (e.g. a wooden block 10x10x10 cm in size).

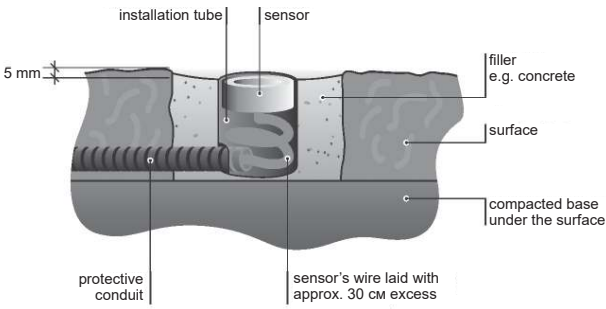
Stage 5: Sensor's installation

1) in-surface temperature and moisture sensor

The sensor should be installed on the previously selected and prepared spot. Remove the wooden block and feed the sensor's wire with the so called "draw wire" into the protective conduit installed before finishing works on the surface. Under the sensor, the wire excess should be deposited (min. 300 mm) for the future sensor replacement, if required.

The sensor should be positioned approx. 5 mm below the surface level to enable water deposition on the sensor. After the sensor has been le-velled, fill the vacant space e.g. with concrete.

Ground temperature and moisture sensor ETOG-56T with installation tube (for soil, concrete flagstones, paving cobbles etc.) can be used for heating control of driveways, traffic routes, etc.



Example of temperature and moisture sensor's installation in the surface

2) on-roof air temperature sensor and moisture sensor

Position the ETF-744/00 temperature sensor on the building's northern wall, in shade.

Position the ETOR-55 moisture sensor between the cables in the roof's channel, optimally in the vicinity of the downpipe.

While selecting the sensors' positioning, take into account the necessity of feeding the wires of both sensors to the controller.

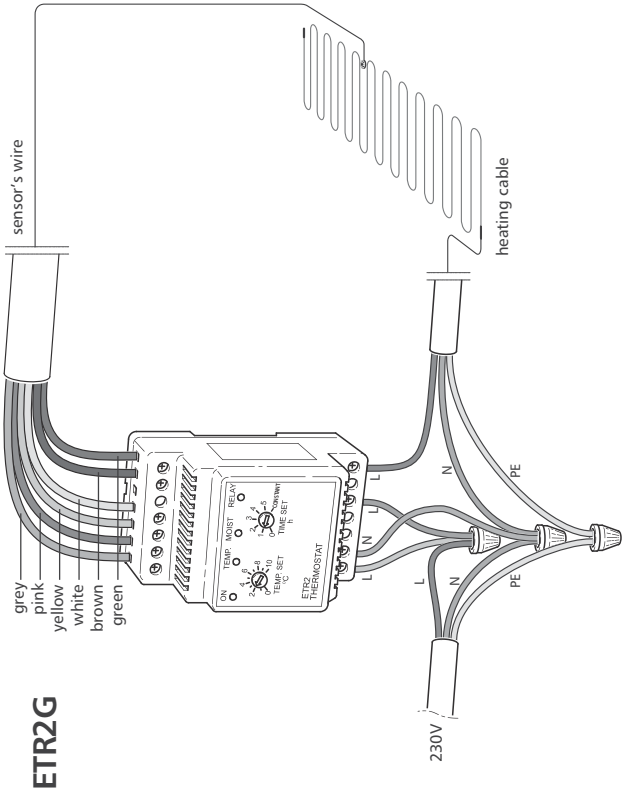
Stage 6: Temperature controller's installation

The heating cable connection to the domestic electric circuit should be performed by an authorised electrician.

The in-controller connection of the:

1. mains,
2. power supply conductors ("cold" cables) of the heating cable,
3. temperature and moisture sensor should be executed according to the diagram included in the temperature controller's Instructions.

For reference, below are example diagrams applying the ELEKTRA ETR2 controller.



Single-phase electric circuit
Connection diagram of ELEKTRA TuffTec™ 30/230V heating cable with temperature and moisture sensor and ELEKTRA ETR2G temperature controller

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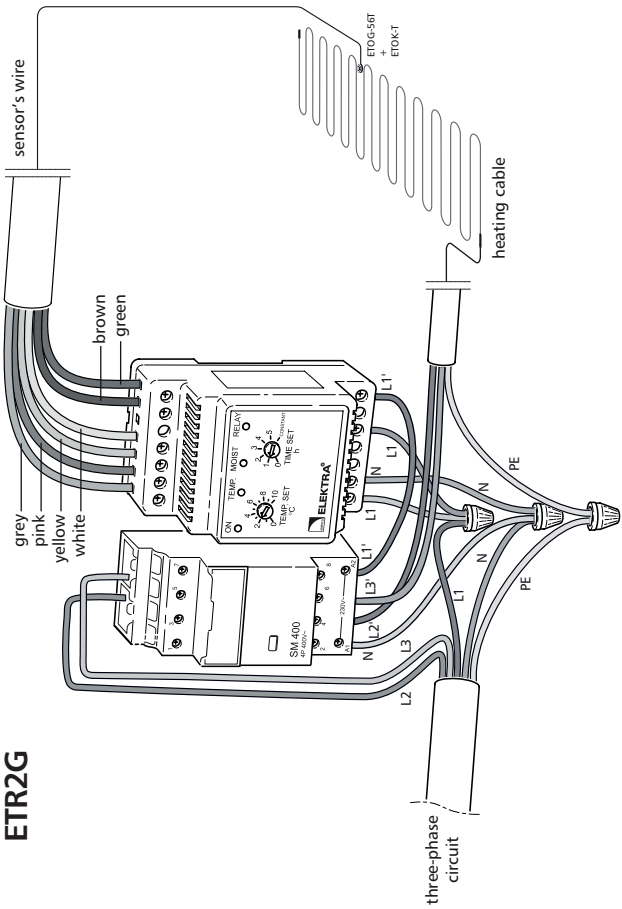
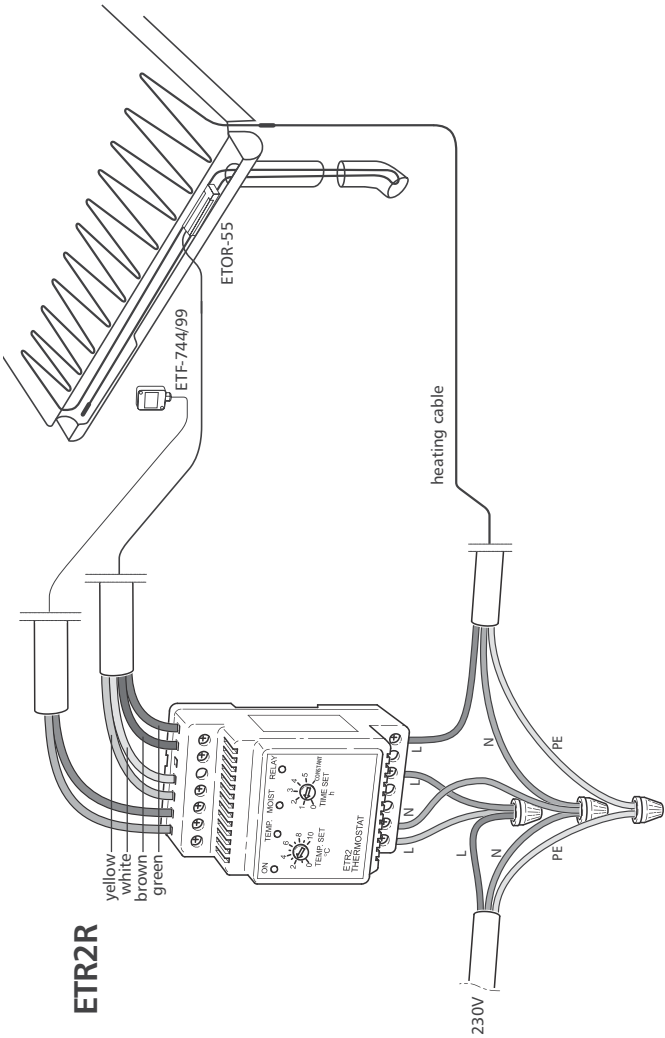


ETR2G

Three-phase electric circuit
Connection diagram of ELEKTRA TuffTec™ 30/400V heating cable with temperature and moisture sensor and ELEKTRA ETR2G controller



Single-phase electric circuit
Connection diagram of the heating cable and temperature and moisture sensor and ELEKTRA ETR2R controller

Anti-shock protection

The electric circuit of the heating cable should be equipped with a residual current device of the sensitivity level $\Delta \leq 30$ mA.

Warranty

ELEKTRA company grants a 10 year-long warranty (from the date of purchase) for the ELEKTRA TuffTec™ heating cables.

Warranty Conditions

1. Warranty claims requires:
   a. that the heating system has been executed in full accordance with the Installation Instructions herein, by a certified electrician,
   b. presentation of the properly completed Warranty Card,
   c. presentation of the proof of purchase of the heating cable under complaint.
2. The Warranty loses validity if any attempt at repair has been undertaken by an unauthorised installer.
3. The Warranty does not cover the damages inflicted as a result of:
   a. mechanical fault,
   b. incompatible power supply,
   c. lack of adequate overload and differential protection measures,
   d. discord of the domestic heating circuit with the current regulations in force.
4. Within the Warranty herein, ELEKTRA company undertakes to bear exclusively the costs required to cover the necessary repairs to the heating cable itself, or to exchange the cable.
5. The Warranty covering the purchased commercial goods does not exclude, limit or suspend other Buyer's rights resulting from the incompatibility of the goods purchased with the agreement of purchase.

Note: !

The Warranty claims must be registered with the Warranty Card and proof of purchase, in the place of purchase or the offices of ELEKTRA company.

The Warranty Card must be retained by the Client for the entire warranty period of 10 years.
The Warranty period starts on the date of purchase

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Heating cables

PLACE OF INSTALLATION

Address			
Zip code		City/town	

The Warranty claims must be registered with the Warranty Card and proof of purchase, in the place of purchase or the offices of ELEKTRA company

TO BE COMPLETED BY AN INSTALLER

Name and surname				Electrical authorisation certificate №	
Address				E-mail	
Zip code		City/town		Phone №	Fax

Heating cable's core and insulation's resistance		
after laying the heating cable		Ω
		MΩ
after the surface has been completed (valid for in-ground applications)		Ω
		MΩ

Date	
Installer's signature	
Company's stamp	

Note: Heating core's resistance measurement result should not vary from the nameplate with more than -5%, +10%. The heating cable's insulation resistance, as measured with a megaohmmeter of the rated voltage 1000 V, should not drop below 50 MΩ.

Heating cable's layout and power supply conduit connection to the switchboard – sketch

Note: The installer is obliged to provide the user with the post-realisation documentation.

NOTE!

Please stick here the self-adhesive rating plate (label)
attached to the product
(to be done before the heating cable has been installed)

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